TEXT EXTRACTION FROM LCD USING OPENCV

Madhavi Bhosale
Computer Science Department, Fergusson college, (affiliated to Savitribai Phule Pune University), Pune,India.
Email: madhavi@fergusson.ed

Saquib Jikare
Computer Science Department, Fergusson college, (affiliated to Savitribai Phule Pune University), Pune, India.
Email: saquibjikare@gmail.com

Nitin Kulkarni
Electronic Science Department, Fergusson college, (affiliated to Savitribai Phule Pune University), Pune, India.
Email: nmkulkarni@gmail.com

Abstract

LCD screens are often used to display real-time results in experiments involving sensors and microcontrollers. The proposed research developed an application that can read any sensor data displayed on the LCD and sent on a webpage. IP webcam is used to capture the image of LCD. The image is processed using the OpenCV module using the python program. The python program was developed to extract the number from the captured image and able to send it to any IoT analytics platform such as ThingSpeak. The captured data in number form can also be visualized on the developed netlify app.

Keywords: LCD, OpenCV,IoT,ThingSpeak

I. INTRODUCTION

In IoT applications, image processing is the most important task when interfacing a camera to microprocessor or microcontroller get involved. In modern era, the processing of vast image data is the challenging part. Many researchers were trying to use many image processing tools such as MATLAB, YOLO, OpenCV, BoofCV, CUDA, TensorFlow, PyTorch, Keras to explore the best tool for the application. For any artificial intelligent system, a camera is the sensory organ to visualize the data. The visual data captured by the camera is the raw data which is the key component of any smart application. Day by day the number of internet of things will get boomed. The more sophisticated applications are required to handle this big data for the correctanalysis. The machine training tools should be evolved for powerful machine learning process. TheGartner hyper cycle drew a hyper cycle of data analysis governance in 2022. This includes process of the data inputting, manipulating, deleting, storing. The hyper cycle predicted the new innovations will happen in data science and machine learning area. The image processing is the definitely an emerging branch of computer science. Image processing is indeed very interesting subject to explore the new horizons of machine vision.[12]

II. LITERATURE REVIEW

Many researchers used different image processing tools for the varieties of the applications.
This paper focuses on using OCR technology to read serial numbers on wine labels for unique identification and information retrieval. This is a useful application for wine originality authentication and counterfeit prevention. The company 13. Jul Plantaže, a large wine producer in Southeastern

Europe, serves as the case study for this research. While this paper does not directly relate to the use of Tesseract OCR for food tracking and tracing, it does provide insight into the potential uses of OCR technology for product identification and tracking. This paper aims to uniquely identify each bottle of wine using OCR technology, which has not been explored extensively in the context of wine tracking and tracing. The use of OCR technology allows for the identification of individual wine bottles without requiring any additional labeling or tracking methods, making it a more cost-effective solution for the wine industry. The focus on the sensors and the use of mobile device cameras to perform OCR and read the product serial numbers sets this paper apart from other research on wine tracking and tracing.[1] This paper discussed the fundamental steps in digital image processing such as Image acquisition, image enhancement, Image restoration, Wavelets, Compression, Morphological processing, Segmentation, Recognition. The paper also described many applications of image processing such as Automatic Visual Inspection, Remotely Sensed Scene interpretation, Biomedical Imaging Techniques, Defense surveillance, Content-Based Image Retrieval, Moving-Object Tracking, Neural Aspects of the Visual Sense.[2] The paper explores the use of OCR for extracting information from visiting cards using Tesseract and Python programming. The related work section highlights the contributions of other researchers in the field of OCR, including the use of Neural Networks and Tesseract for detecting text from handwritten documents, OCR systems for Amharic and English texts, and the comparison of OCR performance on historical documents. Several researchers have also explored OCR for business cards, with high accuracies achieved through the use of NLP techniques and appropriate databases. While this study also utilizes Tesseract for OCR, it focuses on a less complex method of text classification.[3] This paper highlights the importance of a virtual text reader that is automated, efficient, and affordable for visually impaired individuals. The authors discuss two related works in this area, including a portable virtual text reader that reads text aloud using a webcam and OCR for text conversion, and a smart reader for visually impaired people that uses image processing techniques and MATLAB for character recognition and TTS synthesizer for text-to-speech conversion.The authors then present their work, an intelligent text reader based on Python that uses OpenCV for image processing, semantics checks for character recognition, and a Python module-based speech synthesizer for a natural and pleasant audio output. Their product aims to assist visually impaired individuals in an economically and efficient manner, without the use of a GUI to capture the input image. The authors note that their use of OpenCV instead of MATLAB and the combination of image processing techniques and semantics checks for character recognition make their product more accurate and efficient.[4] The paper discusses various methods of text extraction from complicated document images, including those based on local statistical descriptive features, interval type-2 fuzzy, multi-scale binarization, rule-based sampling, and edge analysis. The paper also describes methods of text extraction from preprocessed document images, including those based on Canny edge detection, adaptive linear function, directional wavelet, hybrid binarization, and locally adaptive approach. Despite these methods, text extraction from complicated backgrounds remains an open research issue. The paper proposes a novel and cost-effective method of background image elimination to improve OCR performance.[5] The paper describes several methods and techniques for counting blood cells, particularly red and white blood cells, through the use of digital image processing. The paper also discusses the advantages of using computer-aided blood analysis over manual counting, including increased accuracy and efficiency. The different methods presented include Circular Hough Transform, smartphone-based cloud-assisted resource-aware framework, Artificial Neural Network (ANN), distance-transformed watershed, and morphological watershed transformation. Each method presents a different approach to blood cell counting and classification, but all have shown promising results in terms of accuracy and efficiency.[6] The field of image processing and computer vision has seen significant advancements in various applications, including vehicle number plate detection. In this paper, the authors use various methods, including canny edge detection, for detecting the edges of the number plate for further processing of the image. They emphasize the importance of image preprocessing methods for achieving higher accuracy in methods like RGB to black, blurring, thresholding, and normalization. Other related works mentioned in the paper include the use of Convolutional Neural Networks (CNN), Automatic License Plate Recognition (ALPR), and classifiers like hard cascade and SVM. The authors also mention the use of Tesseract OCR Machine for

converting the processed image into text, with image preprocessing as a crucial step in this process. Additionally, the paper discusses a different approach to license plate detection using ARM-based embedded models and Raspberry Pi.[7] The paper discusses the development of a motion detection system using Python and OpenCV for various applications such as population counting and sensitive area surveillance. The authors utilize image processing techniques such as medium filtering and motion detection algorithms to analyze the images obtained and remove certain features. They also use machine learning models to count people in pictures on previous pixels and achieve high accuracy in detecting multiple individuals. The paper highlights the importance of using open-source tools such as OpenCV and Python for image processing and computer vision applications.[8] Test Marks Summation App Using Tesseract OCR in Python   The affiliated work explored in this paper highlights the challenges of manually grading subjective test scripts, which can be time- consuming and prone to errors. Variety of approaches to automate the evaluation of subjective test scripts have been proposed, including the use of computer vision, natural language processing, and deep literacy ways. still, there are presently no available tools to automatically mark subjective questions and add the total marks. This paper proposes an Android- based Marks Summation App that utilizes the Tesseract OCR library to recognize handwritten marks and perform auto totality. The app aims to simplify the test grading process, reduce errors, and save time for observers.[9] The paper discusses the use of Optical Character Recognition (OCR) and Text Segmentation techniques for the extraction of relevant information from bills and invoices. The Tesseract OCR engine is used for the recognition of alphanumeric characters from scanned images, and the OpenCV tool is used for pre-processing the images by removing noise and unnecessary objects from the background. The paper also highlights the pipeline methodology followed by Tesseract for character recognition and the importance of text segmentation in information retrieval. The edge detection algorithm and contour tracking are used to locate the required object (Bill or Invoice) in the image, which is then cropped out and filtered for better accuracy.[10] Optical Character Recognition (OCR) has been widely studied and developed over the years, and several existing systems offer OCR services. The paper discusses various existing systems in the field of PDF management, such as ILOVEPDF, Adobe Acrobat Pro, and PDF-XChange Editor. These systems have their strengths and limitations, and the paper analyzes their features and capabilities. However, the focus of the paper is on the development of a new web-based optical character recognition system, which aims to improve the accuracy and efficiency of PDF text recognition.[11]

III.   RESEARCH METHODOLOGY

1) When the LCD device has interfaced to any microcontroller, its ports have configured as an output. It is very difficult to read the output displayed on the LCD screen and to send on webpage in an IoT application. The proposed research has been done to overcome this problem so that any sensor data displayed on the LCD display can be sent on webpage.

2) The selection of a camera is a very important decision to take place. The selected camera should be economical as high-definition advanced cameras are costly. Also, it is not easy to interface the camera to the microcontroller or processor. One of the easily available cameras nowadays is a mobile camera which everyone carries. So, in this paper, the mobile camera is used to focus on the LCD screen. To link the images captured by the camera to the python program, here Uniform Resource Locator (URL) connected to the IP webcam application is used.

From the webpage available from the IP webcam as shown in Fig. 1, we can control the front camera or back camera option. The same URL is shared in a python file so we can link the camera to our python file.

3) The flow diagram is shared as Fig. 2 to demonstrate the logic of the python program in a stepwise manner. The program uses the OpenCV, NumPy, PIL, imutils, web browser, sys, and Tesseract libraries. It fetches the image from the IP webcam stream URL and decodes the image array to OpenCV image. It processes the image by converting it into grayscale and applying thresholding, morphological closing, and filtering contours based on their area. The image on the output window draws a rectangle around the largest contour. The grayscale frame with the drawn rectangle is then

converted to a Python Imaging Library (PIL) image. To extract the text from the frame, pytesseract library is used. If the extracted text is a number, then only it is returned to the output.
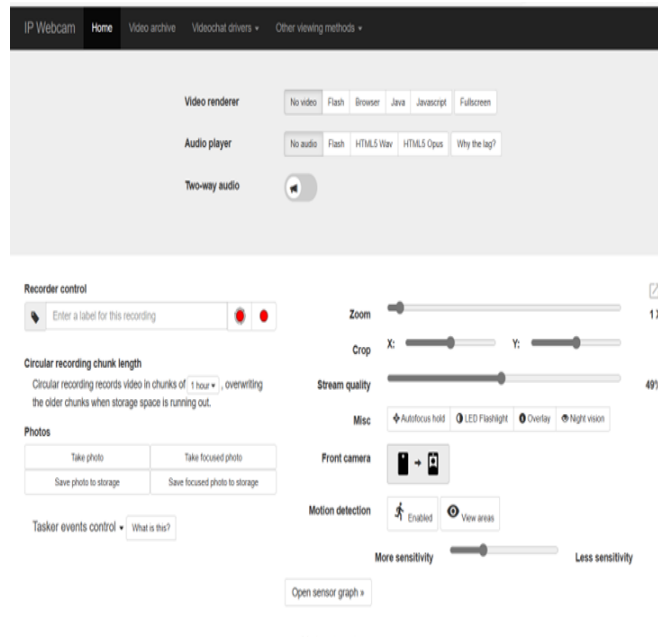

Fig. 1 IP webcam page

4) ThingSpeak, an IoT platform is used to collect and analyze the data only when it receives the number within a specific range. The Write API key and field number of the ThingSpeak channel are required to share to open the URL of ThingSpeak. The output of the program specifies whether the text is sent successfully or not, or whether the number extracted is out of the specified range or not, or whether the number is found in the text or not. The program's primary function is executed continuously while the IP webcam stream URL is online. It uses a try-except block to catch any keyboard interrupt to terminate the program.

5) Netlify.com is used to visualize the data from the static website for free. On this, we can use many repositories if you signed with Github. Deploy your project files on this site in a directory. Link this directory to the site for deployment. After submitting files, the website will be hosted and we'll get a link. We have to use this URL link in a python file to visualize the data.

6) Overall, this code demonstrates how to use computer vision and OCR libraries to extract and process data from an image. Also describes the way to upload the number data on the web application
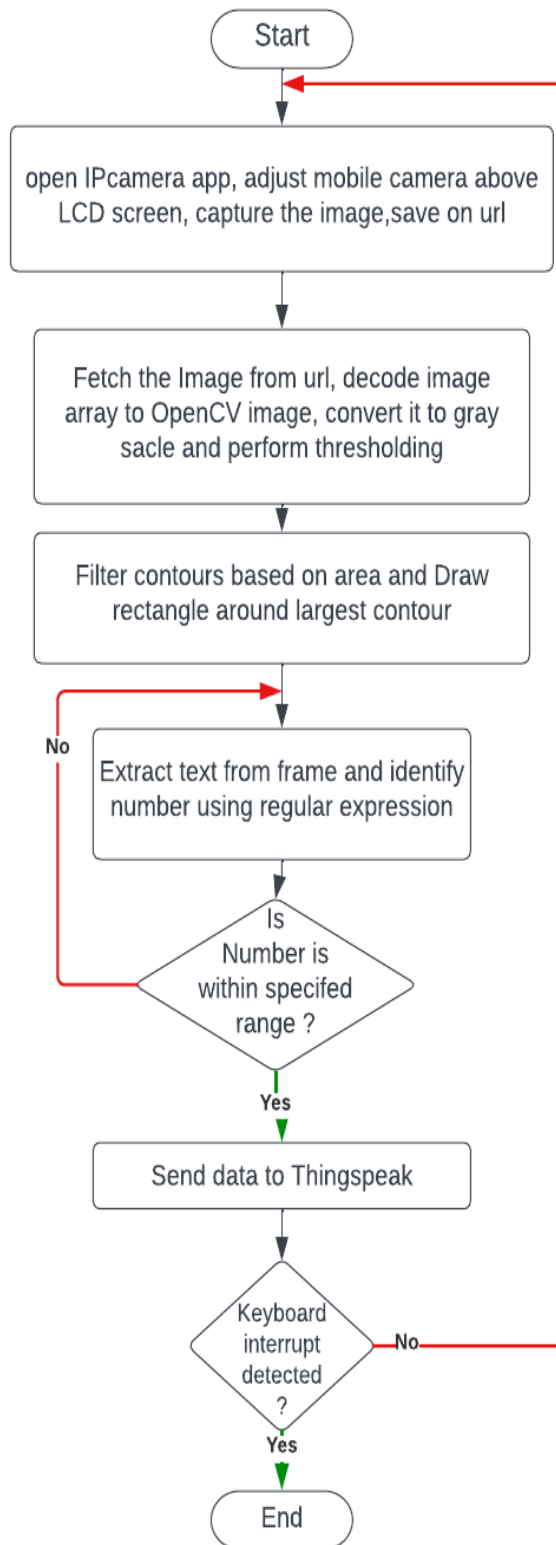
Fig. 2 Flow diagram of the research work

.
IV.   RESULT AND CONCLUSION

The LCD shown in Fig. 3 is attached to a Digital RF power meter which gives the RF power in the dBm unit. The range of the RF power meter is 0 dBm to -75 dBm.Fig 3 shows the green rectangle for getting contour.
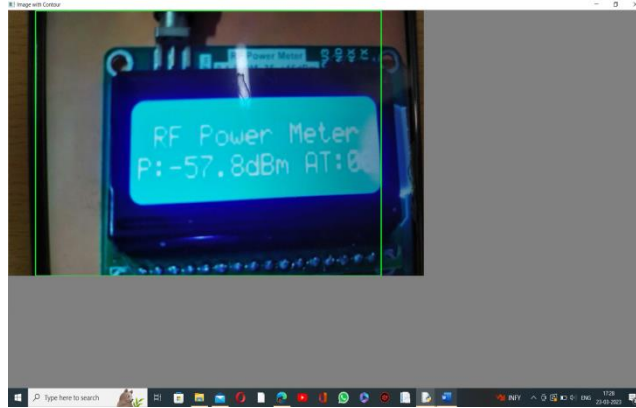

Fig. 3 Output window of the program

Fig. 4 shows the green rectangle around the LCD screen as it was the largest counter. The text was extracted from the frame representing this LCD screen.
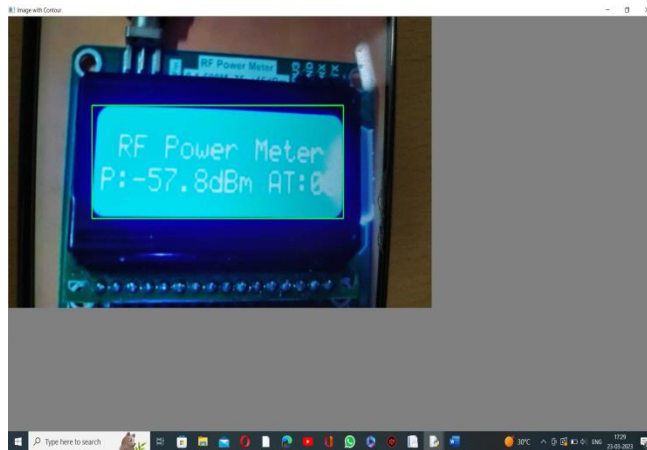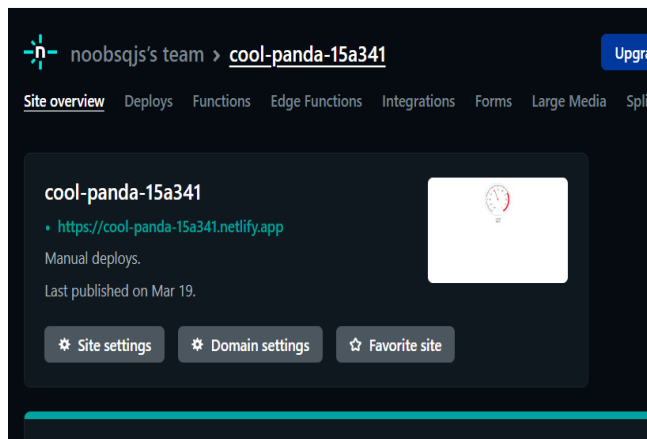

Fig. 4 A Rectangle around the largest contour

Fig. 5 netlify app

After running the python file, we will get the output as shown in Fig. 6. The output window shows the data visualization on netlify application.
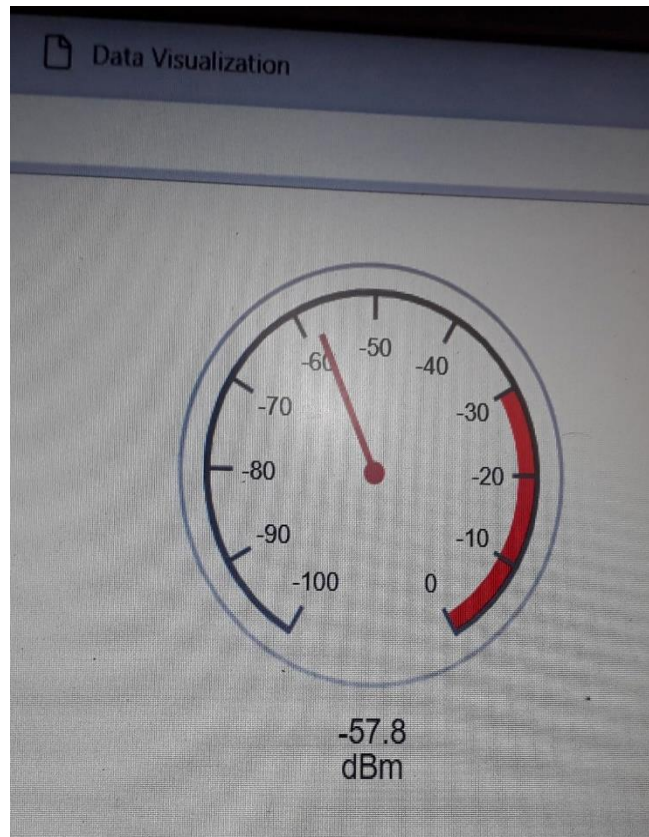

Fig. 6 Data visualization window on netlify app

We can use this logic for any data on LCD streamline to our webpage and share it by making our ThingSpeak channel public.

This research can be useful in various applications, such as automation, monitoring, and data logging. This is where data needs to be extracted from images and analyzed in real time. However, it requires a reliable and stable network connection and may not work well with low-quality or noisy photos.

REFERENCES

[1] S. Cakic, T. Popovic, S. Sandi, S. Krco, and A. Gazivoda, "The Use of Tesseract OCR Number Recognition for Food Tracking and Tracing," 2020 24th Int. Conf. Inf. Technol. IT 2020, no. February, 2020.

[2] R. S. Hegadi, "Image Processing: Research Opportunities and Challenges," Natl. Semin. Res. Comput., no. March, pp. 13–25, 2010.

[3] P. G. Iiitd, M. K. Iiitd, I. B. Iiitd, and D. Mitra, "Information Extraction from Visiting Cards Using OCR and Post-Processing in Python Chandrashekhar Padole (International Business Machines Corporation (IBM)), Uma Shankar Verma (Indraprastha Institute of Information Technology Delhi Diptarshi Mitra (I," vol. 7, no. 5, pp. 1–7, 2022.

[4] P. Manage, V. Ambe, P. Gokhale, V. Patil, R. M. Kulkarni, and P. R. Kalburgimath, "An intelligent text reader based on python," Proc. 3rd Int. Conf. Intell. Sustain. Syst. ICISS 2020, pp. 51–54, 2020.

[5] Mande Shen and Hansheng Lei, "Improving OCR Performance with Background Image Elimination," 2015 12th Int. Conf. Fuzzy Syst. Knowl. Discov. FSKD 2015, pp. 1566–1570, 2015.

[6] R. J. Meimban, A. R. Fernando, A. Monsura, J. Ranada, and J. C. Apduhan, "Blood Cells Counting using Python OpenCV," Int. Conf. Signal Process. Proceedings, ICSP, vol. 2018-August, pp. 50–53, 2019.

[7] A. S. Mohammed Shariff, R. Bhatia, R. Kuma, and S. Jha, "Vehicle Number Plate Detection Using Python and Open CV," 2021 Int. Conf. Adv. Comput. Innov. Technol. Eng. ICACITE 2021, vol. 7, pp. 525–529, 2021.

[8] S. Parveen and J. Shah, "A motion detection system in python and opencv," Proc. 3rd Int. Conf. Intell. Commun. Technol. Virtual Mob. Networks, ICICV 2021, no. Icicv, pp. 1378–1382, 2021.

[9] K. Saravanan, C. C. Chew, K. G. Tay, S. L. Kek, and A. Huong, "Exam Marks Summation App Using Tesseract OCR in Python," Int. J. Integr. Eng., vol. 14, no. 3, pp. 102–110, 2022.

[10] H. Sidhwa, S. Kulshrestha, S. Malhotra, and S. Virmani, "Text Extraction from Bills and Invoices," Proc. - IEEE 2018 Int. Conf. Adv. Comput. Commun. Control Networking, ICACCCN 2018, pp. 564–568, 2018.

[11] W. P. Yong, N. Abdulwahab, and M. Alduais, "Development of a Web-based Optical Character Recognition System," vol. 3, no. 2, pp. 370–387, 2022.

[12] https://t-w-3.com/gartner-hype-cycle-2023-data-industry-trends/